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A Review of the Changing Roles of The Expert and The Public in the Field of Risk Communication

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Introduction

Risk has been defined or conceptualized in a number of different ways. For these reasons the definition of risk can be somewhat elusive. One widely understood definition of risk is the concept used to give meaning to things, forces or circumstances that pose a danger to people and what they value (Stern and Fineberg, 1996). Conceptualizing risk is further complicated by the divergent ways in which experts and the public commonly perceive risk or take different factors into account when assessing its possible impact on social or ecological systems (Douglas and Wildavsky, 1982). For example, professionals and experts often use technical risk assessments and/or consciously calculate risk with equations such as risk=probability×impact (Stern and Fineberg, 1996). Conversely, the majority of the public rely on intuitive risk judgments (what Slovic [1987] calls risk perceptions). Conversely, the majority of the public rely on intuitive risk judgments (what Slovic [1987] calls risk perceptions). There are many factors that influence how members of the public view risk, including familiarity or control of the given risk, its catastrophic potential, the equity of risk exposure, the level of trust in regulators and science, emotions attached to risk, perceived benefit, or risk acceptance (Slovic, 1987; Slovic, 2010; Breakwell, 2007; Lupton, 1999). Such factors "play a large role in determining levels of concern, worry, anger, anxiety, fear, hostility, and outrage, which in turn can significantly change attitudes and behavior (Covello et al., 2001, p.384)." I maintain that it is necessary to understand these factors, including cultural influences, individual backgrounds, and the underlying social context, when predicting how the public will view and understand a risk.

Effective risk communication is critical due to the hazards that society encounters. Beck (1992) argues that we exist in a risk society and places a heavy emphasis upon the novelty of our situation. By this he suggests that contemporary risks can be more apocalyptic than earlier periods. For example, a nuclear disaster poses a man-made threat that has the poten-

tial to cause great harm. This type of risk did not exist in previous centuries. In a democratic society, people have a greater opportunity to determine what risks we encounter. For example, we can decide whether or not to support a hazard (such as a nuclear power plant development). Therefore, it is critical that experts and the public engage in a dialogue to effectively communicate risks and benefits. Risk communication adds to the overall field of communication because it provides techniques and theory to better communicate about risks and hazards. It has enhanced the field of communication through the examination of risk perceptions (Slovic, 1993), the importance of trust and transparency in dialogue and the social context behind many the understandings of messages (Breakwell, 2007).

The terms expert and public used throughout this manuscript refer to two different populations defined both by their role in society and the ways that they view and understand risk (Fischhoff, 1995; Sjoberg, 1999 for similar usage of terms). I do not imply that the expert is right and the public is wrong or vice versa. Rather, it denotes two different standpoints concerning risk (Powel and Leiss, 1997). A commonly used definition of an expert is someone who has specialized knowledge about issue (in this case a risk) and who uses published scientific literature and scientific terminology to make sense of that issue (Leiss, 1991; Slovic, 1993). The public (i.e. non-expert) refers to people who view risk within the context of their everyday experiences and use ordinary language to make sense of that risk (Leiss, 1991; Plough and Krimsky, 1987). Risk perception and communication research has predominantly focused on developing a better understanding of how the public makes decisions about risk and how this compares to expert assessment (Fischer, 2004; Breakwell, 2007). This has lead to a historical dominance of research on how the public can make more informed decisions (Morgan et al., 2002), often guided by the notion that the public requires more information to make increasingly rational decisions (Miller, 2001). I argue that focusing on the disconnect between the publics' experiential approaches to risk assessment and experts' more cognitive assessments of risk complicates effective communication. Instead emphasis should be placed on a participatory approach with a focus on true collaboration between expert and public .

The goal of this manuscript is to review the literature on risk and risk perceptions, focusing specifically on the changing roles of the expert and the public in weighing and communicating risks. I discuss the evolution of the risk perception and risk communication fields. The following section will compare how the public and experts differ when it comes to thinking about, perceiving and making judgments about risks. I then briefly discuss how research in the field of public understanding of science can advance the field of risk communication and management. Finally, I

discuss how focusing on the divergent views of risk among experts and the public often hinder fair and effective risk communication and provide recommendations for future risk communication initiatives.

The Evolution of Risk Research Involving Experts and the Public

The field of risk and risk perception has continued to evolve during the past few decades (Breakwell, 2007). This is especially true regarding our conception of the roles played by experts and the public in weighing and communicating risk (McComas, 2006). Risk perception researchers have begun to shift their focus from examining deliberate, conscious and mechanistic methods of probabilities and payoffs in regards to risk. The emerging paradigm in risk is one that takes into greater account the variety of social contexts that shape risk and the variation in perceptions among individuals and groups (Gurabardhi et al., 2004). More specifically, researchers have shifted from purely cognitive approaches of risk perception by integrating approaches that better take into account the affective (i.e. emotional) qualities (Slovic, 2010). There is also less of an emphasis on expert decisions regarding what views of risk are relevant to the larger public (McComas, 2006).

Leiss (1996) and Fischhoff (1995)[1] have discussed this evolution in two seminal papers on risk communication and how it changed the way communicators and managers approach risk and consultation with the public (see Table 1 for a summary). Both Leiss and Fischhoff conclude that the purpose of risk communication is to develop a partnership between experts and the public to facilitate the assessment, communication and management of risks. However there still remains a stronger emphasis on providing technical information to the public about risks rather than creating effective partnerships (Leiss, 2009). The following pages will summarize and critique these arguments.

Both Fischhoff (1995) and Leiss (1996) describe the progression of risk perception and communication through the use of development stages (i.e. Fischhoff) or three phases (i.e. Leiss). Leiss (1996) describes the earliest phase (occurring between 1975-1984) as placing emphasis on experts' expressions of risk estimates. Fischhoff (1995) describes two stages of risk occurring during this same time period. Both involve risk communicators and scientists' beliefs that: "(1) all we have to do is get the numbers right" (p.138) (i.e. we do not need to communicate with the public); and "(2) all we have to do is tell them the numbers" (p.139) (i.e. we just need to hand over the analysis and the numbers will does not require explanation). This phase involved very little to no communication between the public and the experts. Many scholars believed that these expert risk estimates

1. This review is based on the manuscripts written by Professor William Leiss and Professor Baruch Fischhoff; therefore, a brief introduction of the two scholars is provided here. William Leiss is a professor at the McLaughlin Centre for Population Health Risk Assessment, University of Ottawa. He has examined communication, assessment and perceptions of risks such as genetically modified foods, nuclear waste disposal, genetic engineering, and Mad Cow Disease among many others. Baruch Fischhoff is a professor in the departments of Social and Decision Sciences and of Engineering and Public Policy at Carnegie Mellon University. Fischhoff has examined risk communication, perceptions and decision making of risks including terrorism, climate change, cancer, nuclear waste, etc. Both Leiss and Fischhoff are considered experts in risk communication and base their seminal papers on their years of experience in the field of risk.

not only prioritized, but reflected public concern, therefore setting the agenda for regulatory action (Breakwell, 2007; Lofstedt, 2009). It is now widely acknowledged that expert and public conception of risk often differ dramatically, as do their priorities for managing various risks (Heath, 2002; Lofstedt 2004). In my experience and past research, it is clear that the public expects meaningful dialogue with risk managers, policy makers and communications and insists on having a voice in deciding the how to deal with the risks they face.

Table 1 Summary of The Evolution of Risk Perception and Risk Communication Research from Leiss (1996) and Fischhoff (1995)

Time Period	Leiss (1996)	Fischhoff (1995)
1975-1984	**Phase 1**: Emphasis on experts' risk estimates	1. All we have to do is get the numbers right 2. All we have to do is tell them the numbers
1985-1994	**Phase 2**: Stressed characteristics of successful communications	3. All we have to do is explain what we mean by the numbers 4. All we have to do is show them that they have accepted similar risks in the past 5. All we have to do is show them that it is a good deal for them 6. All we have to do is treat them nice
1995- Present	**Phase 3:** Emphasis on social context and partnerships	7. All we have to do is make them partners 8. All of the above

Both Fischhoff (1995) and Leiss (1996) describe the progression of risk perception and communication through the use of development stages (i.e. Fischhoff) or three phases (i.e. Leiss). Leiss (1996) describes the earliest phase (occurring between 1975-1984) as placing emphasis on experts' expressions of risk estimates. Fischhoff (1995) describes two stages of risk occurring during this same time period. Both involve risk communicators and scientists' beliefs that: "(1) all we have to do is get the numbers right" (p.138) (i.e. we do not need to communicate with the public); and "(2) all we have to do is tell them the numbers" (p.139) (i.e. we just need to hand over the analysis and the numbers will does not require explanation). This phase involved very little to no communication between the public and the experts. Many scholars believed that these expert risk estimates not only prioritized, but reflected public concern, therefore setting the agenda for regulatory action (Breakwell, 2007; Lofstedt, 2009).). It is now widely acknowledged that expert and public conception of risk often differ dramatically, as do their priorities for managing various risks (Heath, 2002; Lofstedt 2004). In my experience and past research, it is clear that the

public expects meaningful dialogue with risk managers, policy makers and communications and insists on having a voice in deciding the how to deal with the risks they face.

The second phase of risk communication defined by Leiss (1996) (between 1985-1994) put emphasis on the communicative process surrounding risk. This included source credibility of risk communicators, message clarity, and the medium used to communicate messages. Ultimately the goal was to provide residents with more scientific information and thus close the gap between public and experts risk assessments (Slovic et al., 2000). Fischhoff describes four development stages that defined this same time period: (1) "all we have to do is explain what we mean by the numbers" (p.138). For example, showing the public high-risk probabilities calculations of an earthquake in an area and expecting that they will move to another location. (2) "All we have to do is show them that they've accepted similar risks in the past" (p.138). For example, telling someone who smokes that they have a greater chance of dying from their smoking habit than from an airplane crash and expecting that they will now take air transportation. (3) "All we have to do is show them that it's a good deal for them" (p.138) For example, telling someone that the benefits of nuclear power outweigh the small possibility of a nuclear disaster and expecting that they will accept a nuclear power plant in their town. (4) "All we have to do is treat them nice" (p.138)." For example, the developer of a hydroelectric power plant thinks that just being nice and building a relationship with the public will ensure that they will accept the project. The intent of risk communication during this period was to persuade at-risk populations to accept and employ the strategies advocated by experts rather than incorporating their understandings into a more holistic starting point for risk mitigation (Gurabardhi et al., 2005). I affirm that aspects of these four stages are important aspects of communication and are requirements for effectively building dialogue. It is necessary to build relationships and to explain the experts' points of views. However, persuasion research using cognitive models is a large focus of this period and attempting to understand how to encourage rational decision-making was the primary goal (Renn, 1992). As such, researchers and risk communicators were less concerned with affective components of risk or the emotions that influenced public response (Gurabardhi et al., 2005).

Leiss' (1996) third phase of risk communication (1995 – present) is dubbed the new model or two-way model of risk communication (Heath et al., 2002). Fischhoff defines the primary addition to this development stage through the phrase "all we have to do is make them partners (1995, p.138)" while implying that the previous stages need to be retained. The concept of partnership between experts advanced the focus on techniques of

persuasive communication by incorporating the ideas of dialogue, conflict resolution, consensus building and relationship development among parties involved with or affected by a given risk (Heath et al., 2002; Leiss, 1996). Thus the third phase is characterized by the acknowledgement that the expert can no longer just provide a risk estimate or more information to the public, rather they must engage in partnership with the public to: (1) better understand each others views and goals; and (2) make risk management decisions together.

The two-way model of risk communication is described as something that risk communicators and risk perception researchers should strive for (Leiss, 1996). There are many practical examples for why it is important to strive for a two-way communication model. Trying to persuade a population to do something (through a one-way information flow), such as telling people to evacuate from a flood may not be effective. Communicators and managers must know what the restrictions are (ex. physically unable to evacuate), what is important to a person (ex. they do not want to leave a possession), among many other factors. If a communicator has not engaged in a two-way dialogue and does not know what factors make evacuation difficult to a person; the person is unlikely to head the communicators instructions. Yet risk communicators and researchers do not often adhere to the new model, tending instead to stress the communicative process that seeks to educate the public (Leiss, 2009; Breakwell, 2007). This is particularly true of technological developments, where the emphasis is on providing at risk populations with information (i.e. pamphlets and information sessions) rather than engaging with them and developing a two-way flow of information. The following section focuses on why adhering to a true two-way communication model is important because experts and non-experts often perceive and judge risks differently.

Experts and the Public: Viewing, Perceiving and Judging Risks Differently

The dominant research approach in the field of risk perception has been cognitively based (Breakwell, 2007). Researchers most often use various psychological models of human behavior to better understand and attempt to predict the ways in which people think about and respond to risk (Gurabardhi, 2004). Frequently these approaches compare expert's analysis about a risk to the subjective understanding of the public (Slovic, 2001). The cognitive approach assumes that individuals are calculating, entirely rational and non-emotional actors who produce similar responses to risk (Lupton, 1999). This approach is problematic as Garvin (2001) reports "sci-

entists, policy makers and the lay people employ different, though equally legitimate, forms of rationality when evaluating evidence and generating knowledge about hazards (p.452)." Experts generally utilize technical language (characterized by probabilities, statistics, and terms common to disciplines such as toxicology, epidemiology and others) and employ specialized scientific knowledge about a risk (Powel and Leiss, 1997). The general public approaches risk assessment by drawing on everyday experiences within a specific social and cultural context (Douglas and Wildavsky, 1982). For instance the public might base their judgments on responses to the following hypothetical questions: Can I trust the developers or regulators? Will it affect my social well being and relationships with others? Have I had a say in a development? Who bears the costs and who gains the benefits? These and many other considerations made by those at risk will form the basis of a risk judgment.

Both practical experience and research demonstrate that individual members of the public can experience risk differently. For instance Douglas and Wildavsky (1982) contend that the experience of risk is as much about the characteristics of the individual(s) who may be exposed as it is about the occurrence, likelihood or potential impact of the event in question. Acknowledging the inescapably social character of risk, whether it be the personal morals or values of an individual making risk decisions, or the social norms that dictate collective action, means reflecting on the ways that the reality of any risk cannot be a unidirectional process of assessment passed down from the experts of a subject. Breakwell (2007) summarizes this sentiment by stating that risk is likely to be tacit, experiential and individualized for the public.

There are a number of differences in the ways experts and the public communicate or think about risks. Experts generally seek legitimate evidence from studies that adhere to the scientific method; the public generally utilize more of an intuitive thought process about risks and rarely select risk based on direct evidence (Douglas and Wildavsky, 1982). Experts use probabilistic language to assess or define risk while the public is not comfortable with or cannot effectively utilize probabilities and statistics to make sense of risk (Tversky and Kahneman, 1974). Experts often weigh all deaths equally. Meanwhile the public is often more concerned with who and how people die (i.e. child vs. adult; voluntary vs. involuntary exposure) in assessing potential risk impact (Powel and Leiss, 1997). It is also clear that some ways of falling ill or dying are more feared than others. Experts generally accept uncertainty while the public will often suggest that there needs to be more certainty (i.e. is it safe or is it not safe?) (Johnson, 2003; Powel and Leiss, 1997). In addition, experts will normally rank risks as less dangerous than members of the public. Research demonstrating these

facts are numerous including: toxicology hazards (Krause et al., 1992; Slovic et al., 1995; Slovic et al., 2000), ecological risks (McDaniels et al. 1997; Lazo et al., 2000), and the nuclear industry (Slovic, 1987; Flynn et al., 1993).

Nuclear energy has been a common topic in risk perception research partly because of the often dramatic opposition of the public, while the experts generally advise that the technology is safe (i.e. the public will often rate the risks as higher than an expert would rate them) (Slovic, 1987). According to research utilizing the psychometric paradigm, the public is generally opposed to nuclear energy because the risks are uncontrollable, inequitable, catastrophic and likely to effect future generations (Slovic, 1987). Researchers in the behavioral sciences suggested that the solution to these oppositions was to better inform and educate people about risk, thus bringing them more in line with scientists' perspectives (Slovic, 2000). As one nuclear physicist and advocate of nuclear power said: "the public has been driven 'insane' over fear of radiation [from nuclear power]. I use the word 'insane' purposely since one of its definitions is loss of contact with reality. The public's understanding of radiation dangers has virtually lost all contact with the actual dangers as understood by scientists" (Cohen, 1983). Many later acknowledged that an increase in education or reassuring the public would likely never result in the alignment of public and expert perceptions of nuclear power, partially because of the lack of trust the public had in the developers and regulators of the nuclear industry (Wynne, 1992; Slovic 1987).

When it comes to evaluating scientific claims and judgments about a risk the public does not always take them at face value. The public often dismisses evidence provided by the expert if it fails to be considered common sense. When this occurs, members of the public are more likely to seek information from popular sources (Breakwell, 2007). Wynne (1992) developed a framework that proposed a set of common mental rules that lay people will often use when evaluating scientific advice and expertise. These rules and questions the public use include (Wynne, 1992; As summarized by Nisbet and Scheufele, 2009, p.1769):

• Does scientific knowledge work? Do public predictions by scientists fail or prove to be true?

• Do scientists pay attention to other available knowledge when making claims? Are scientists open to criticism? Are they willing to admit errors and oversights?

• What are the social and institutional affiliations of scientists? Do they have a historical track record of trustworthiness? Similarly, do they

have perceived conflicts of interest relative to their associations with industry, government, universities, or advocacy groups?

• What other issues overlap or connect to the publics' immediate perception of the scientific issue?

• Specific to risks, have potential long-term and irreversible consequences of science been seriously evaluated and by whom? Do regulatory authorities have sufficient powers to effectively regulate organizations and companies who wish to develop the science? Who will be held responsible in cases of unforeseen harm?

It is unclear whether experts' perceptions about the severity of a given risk is limited to just his or her field of expertise. Some studies (see for example Krause et al, 1992; Thomson et al., 2004) have found that experts rank a variety of events as less risky than the public even in areas outside their field of knowledge or responsibility. There also is evidence that experts are more likely to produce risk estimates that bear closer resemblance to empirical data (Breakwell, 2007; Wright et al., 2000). Other studies contend that lower risk perceptions of experts are often limited only to their area of expertise. They may be just as likely to perceive other risks in the same manner as a member of the public (Sjoberg, 2002).

The Field of Risk Communication and Implications for Public Engagement

Beyond Cognitive Explanations: The Affect Heuristic

Risk perception research has begun to acknowledgement that risk perceptions stem from more than just analytical processes (Slovic, 2010; Finucane et al., 2000). The traditional dominance of cognitive theories and models for explaining risk perceptions have been challenged by the move to examine emotions or affect (Breakwell, 2007). Affect can be described as the specific quality of goodness or badness that a risk may have (Slovic and Peters, 2006). Likewise the affect heuristic describes how people attribute and quickly recall the goodness or badness of a risk (or associated risks) in decision-making. Affect reactions often occur automatically and guide information processing and judgments (Lowenstein et al., 2001). Some researchers have even argued that emotions have primacy over cognition in the evaluation of risk (Finucane et al., 2000). This is because emotion can be more immediate and pervasive than cognitive computations of the likelihood of benefit or harm (Slovic et al., 2004; Zajonc, 1980). In extreme cases emotional reactions may even block (instead of just modify) the cognitive reaction to a hazard (Epstein, 1994). Breakwell (2007, p. 110) suggests that the initial emotional response to hazard may take on a number of influential roles including:

• Imposing filters on what information is selectively attended to

• Justifying, discounting, or accentuating the importance of the information

• Providing explanations or rationalizations for decisions retrospectively

The explicit acknowledgement of affect is fairly new within the risk perception research field. Yet there are earlier studies that foreshadowed the growing importance of emotional response, although it may not have been recognized as such (Slovic et al., 2010; Slovic et al., 2004). For example the dread factor in public risk assessment was an important indicator for determining a public perception of risk in studies (Slovic, 1987; Slovic, 2010).

Affect is particularly important regarding technological risks. Peters and colleagues (2004) contend that there are both emotional and cognitive perquisites to public assessments of technological hazards. A risk may be unacceptable not only because the negative factors associated with it (cognitive) are too large, but also because it gives rise to a chronic negative affective reactions among members of the public. The result is often opposition or lack of support for the technology that may create a future risk (Flynn, 1993). For example, the emotional reactions surrounding nuclear reactors and the strong affect-laden imagery associated with possible radioactive waste contributed to a high perceived risk among members of the public (Peters et al. 2004). For these and other reasons, many scholars contend that any analysis of risk perceptions and/or decision making that does not take into account the affect attached to a hazard or the emotional state of the individual is flawed (Breakwell 2007).

I have stated throughout this manuscript that affective responses to hazards are a strong characteristic of publics risk assessments. The predominance of the affect heuristic among the public reflect simple truths that have long underscored human response to risk: (1) Humans often fear what they cannot comprehend or control; (2) The increasingly hectic lives of the average citizen make it much more difficult to devote the amount of time necessary to become knowledgeable enough of a risk to understand the probability of impact; (3) Not all lay people can be convinced to think in purely scientific or rational terms, and even if they could, they might choose not to; (4) Risk is reflexive exercise—the diversity of experiences and values make uniform approaches to hazard an impossibility; and (5) That sometimes all the reassurance or facts in the world are not enough to assuage the guttural, pervasive and emotional responses that are part

of human nature (Slovic, 2010). It is therefore unlikely that any society will ever see perfect correspondence between experts and the public regarding risk perception. In the wake of that acknowledgement, it is imperative that risk managers forge ever-evolving definitions of risk that reflect both their expert knowledge and the input of those who may view it from different perspectives. The result is risk management that evolves both in response to the cognitive and affective components of a risk—to the advancements in technology and the shifts in the society creating them.

Risk Communication Failures: Lessons Learned Through the *Deficit* Model

Risk communication approaches that are based only on cognitively based understandings of public risk assessment, or that focus primarily on how the public view risks differently from experts will be a barrier to fair and effective risk management and communication (Powel and Leiss, 1997). I will focus on three major contributions that can cause such failures in risk communication. For one, the notion that science literacy is the cause and the solution to rejection of risk or technology is problematic. Second, a failure to recognize (and accept) the differences in expert and public risk assessments hinders successful risk communication. Finally, risk communication must acknowledge the factors that influence risk perceptions and the social and cultural contexts that they reside in.

Studies concerning the public understanding of science could help advance risk research regarding attempts to inform the public of risks. In past decades it was believed that science illiteracy and ignorance was at the root of social conflict over science (Ziman, 1991). The solution (as described previously) was to educate the public though science media, with a particular focus on the technical details of risks (Miller, 2001). Promoters of this idea believed that the public would be more likely to judge and decide upon scientific issues in the same (or at least more similar) manner as scientists (Burns et al., 2003). It was assumed that the facts speak for themselves and that the public would interpret those facts in a similar way to which an expert views them. This approach is termed the deficit model and it involved a top-down communication process where scientists "filled the knowledge vacuum in the scientifically illiterate general public as they saw fit" (Miller, 2001, p. 116). If people did not understand, recognize or accept the facts as true then this was blamed on the media or the irrational public (Bauer, 2009; Nisbet and Scheufele, 2009; Miller, 2001).

Reports on efforts to improve science literacy among the general population suggest that little has been achieved (Miller, 2001). Consequently, scientific literacy has only a limited role in shaping public perceptions and decisions (Nisbet and Scheufele, 2009; Nisbet and Goidel, 2007;

Scheufele et al., 2009). In fact there is some evidence that increasing the amount of information provided about a risk can actually increase resistance to it among members of the public (Davidson and Freudenberg, 1996). There are a number of reasons why the idea that the public is scientifically illiterate or irrational is problematic. It can further alienate the audience by emphasizing what is wrong with their existing views (Nisbet, 2009). Science claims also can further alienate those who may already be distrustful of scientists if those claims are proven false or inaccurate.

Nisbet and Scheufele (2009) call for science communication initiatives that are guided by careful formative research that facilitate conversations with the public and that recognize, respect, and incorporate differences in knowledge, values, perspectives, and goals. There is a growing recognition that effective communication requires dialogue (not a one way communication stream), trust, relationships and public participation (Gross, 1994). Researchers have dubbed this the contextual model:

> The deficit model is asymmetrical: it depicts communication as a one-way flow from science to its publics . . . (whereas) the contex tual model explores the ramifications of its very different root metaphor; the interaction between science and its publics. In consequence, the contextual model is symmetrical: It depicts communication as a two-way flow between science and its publics. The contextual model implies an active public: it requires a rhetoric of reconstruction in which public understanding is the joint creation of scientific and local knowledge . . . In this model, communication is not solely cognitive; ethical and political concerns are always relevant. (Gross, 1994 as cited in Burns et al., 2003, p.190)

The contextual model acknowledges that while scientists may have scientific facts, concerned members of the public have local knowledge, an understanding of, and personal interest in the problems that need to be solved (Miller, 2001; Burns et al., 2003). However, there is indeed still a technical knowledge deficit between experts and the public. "Scientists and lay people are not on the same footing where scientific information is concerned, and knowledge won by hours of research, and tried and tested over the years and decades, deserves respect (Miller, 2001, p.118)." Yet the same should also be true regarding experts respect for the lived experience that contributes to residents risk perceptions. This knowledge and understanding should be tapped to determine the best strategies for risk management and communication. The result is the nurturing of better relationships between the groups (Fischhoff, 1995).

Recommendations for Engagement

Calls for a shift from the one-way transmission model of science communication has lead to a renewed focus on collaborative, two-way communication strategies that seek to empower citizens to have an active role in decision making. An example of such an approach is consensus conferencing, where a well-briefed lay group of citizens evaluate new scientific approaches and issues (Einsiedel et al., 2001). Lay participants are recruited and given background information in advance so that they can then provide input on the types of questions they would like addresses or policy recommendations for a given scientific development (Joss and Durant, 1995). Participants engaging in these initiatives not only increase their knowledge about the technical aspects of given science, they provide insight into the discussion about the social, ethical and economic implications of science (Rowe and Frewer, 2000; 2005). Participants involved in these initiatives also: (1) feel more confident in their ability to participate in science decisions; (2) are more likely believe that institutions are more responsive or care about their concerns (Groffman et al., 2010); and (3) may become more active concerning the issue in question (Besley, 2010). Nisbet and Scheufele (2009) contend that deliberative forums "can shape perceptions of scientists as open to feedback and respectful of public concerns, perceptions that predict eventual acceptance and satisfaction with a policy outcome, even if the decision is contrary to an individual's original preference" (p.4).

The public often desires an active role in decision making about risks (Heath et al., 2002). Scientists in multiple fields can learn from the idea of the citizen expert (Wynne, 1982; Tesh, 1999) or indigenous technical knowledge (Brokensha et al., 1980) which describes lay peoples' unique understanding of how their world works and the role of a risk within that context. These insights can provide valuable insight into the decision making process that cannot be overlooked by experts. Discussing risks with the public and asking (sincerely) for their suggestions also redefine their relationship with experts. It would communicate recognition and respect for the public's reality and competence (Fischhoff, 1995), thereby improving both groups understanding of risk management.

Conclusion

The progression of risk communication has been characterized by the move away from a technical perspective, where risk issues are left only to

experts with specific knowledge and the focus on what the public should know. The technical perspective put a great deal of effort on the value of rationality, efficiency and facts. In contrast, the emerging two-way risk communication perspective focuses on the democratic view and the realization that there is no one objective view of risk, both experts and the public bring vital information and risk perceptions to the table. Two-way risk communication is characterized by dialogue concerning risk and science. While this is a significant advance for the field, I have used this manuscript to introduce additional steps that risk communicators can take to make the process more efficient and effective.

There is still a need to utilize cognitive approaches and models in risk research as individuals' perceptions are the result of both cognitive (i.e. analytical) and affective (i.e. experiential and emotional) factors. Likewise there is an important place for both the practice of consultation with the public (a two-way process) and initiatives designed to inform them about risks. Communicators should assess what the public knows about a risk in order to determine what topics require further consultation and to better design communication efforts about aspects for which there is a great deal of uncertainty. The more the public knows about the technology, the more they will like it or reject it (Maharik and Fischhoff, 1993). However, this is just one piece of the puzzle. As stressed throughout this manuscript, there is a need to understand the social context in which a given risk exists. It also is critical to understand what is important to the individuals and groups who may be affected by a risk. Regarding the interaction between experts and the public, there needs to be mutual respect for the ways in which each conceptualizes risk and the specialized knowledge they can contribute to a given decision-making process. Finally there needs to be a partnership in decision-making among the public, and those who implement the risk. Although this last point has been advocated by certain scholars for decades, more work is needed to make it a common and integrated practice in decision-making and risk communication.

Author

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